REMARKS

Claims 1-24 are pending in the application and are rejected. Claims 19-24 are objected to.

Claim Objections

Claims 19-24 are objected to for being a substantial duplication of claims 1, 2, 4 and 6-8. In response, Applicants amend claims 19-24 as shown above and request reconsideration.

Claim Rejections

Claims 1-24 are rejected under 35 U.S.C. § 103(a) for being unpatentable over U.S. patent 5,394,473 (referred to as "Davidson") in view of U.S. patent 5,107,345 (referred to as "Lee") further in view of Holmes et al., "Speech Synthesis and Recognition," 2nd ed., Taylor & Francis, 2001, pp. 161-164 (referred to as "Holmes").

Independent Claim 1

With regard to claim 1, the Office Action alleges the following:

- Davidson discloses all that is claimed except for obtaining plural spectral components representing the same frequency and applying an adaptable-length secondary transform to blocks of the spectral components to generate hybrid-transform coefficients;
- Lee discloses a system that groups coefficients of similar frequency;
- Holmes discloses an adaptable-length transform that is applied to frequency coefficients;
- it would have been obvious to combine these teachings from Lee with the teachings in Davidson to maximize the efficiency of coding; and
- it would have been obvious to combine the teachings from Holmes with the teachings in Davison and Lee to separate excitation components from filter components.

Applicants agree Davidson does not disclose the two features mentioned in the Office Action but they respectfully disagree with the remaining four allegations for reasons that are discussed below. Applicants submit that (1) the alleged motivations to combine teachings would not have existed and (2) these combined teachings do not teach all features of what is claimed.

The following discussion is introduced by a summary of the cited art that is relied on.

<u>Summary of Cited Art</u>

Davidson discloses several embodiments of audio encoders in which an adaptable-length transform is applied to overlapping blocks of one-dimensional (time) audio samples to generate variable-length sets of transform coefficients. The coefficients in each set of transform coefficients

collectively represent a range of frequencies across the bandwidth of the input audio signal. No two coefficients in a respective set represent the same frequency or the same range of frequencies.

Lee discloses several embodiments of video encoders in which a two-dimensional transform or two successive one dimensional transforms (see col. 4 lns. 16-19) are applied to non-overlapping two-dimensional blocks (horizontal x vertical) of video pixels to generates sets of transform coefficients. The coefficients in each set of transform coefficients collectively represent a range of two-dimensional spatial frequencies of the input video signal. All of the coefficients along each diagonal across the image represent the same or a similar sum of horizontal and vertical frequencies, which is regarded to be the same or a similar frequency (see col. 13 lns. 61-63).

Holmes discloses several aspects of a technique known as cepstral analysis that can be used to model speech signals as a vocal-tract filter (typically represented by a set of filter coefficients) and its input signal (referred to as the excitation signal). According to Holmes, this technique comprises computing a Fourier transform of the log-magnitude spectrum of a speech signal to obtained the so-called cepstrum (see p. 162) and then analyzing the cepstrum to identify pitch and/or separate the excitation signal from the vocal-tract filter.

Motivation to Combine Teachings from Davidson and Lee

With regard to this discussion regarding motivations to combine, Applicants are aware of changes in the law that have reduced the requirements needed to show a motivation to combine. For example, an acceptable motivation need not be found in the prior art but can be speculative. Nevertheless, the motivation must be based on facts and arguments that show a motivation could have existed. In this instance, Applicants respectfully submit the alleged motivations could not have existed for the reasons that are discussed below.

The Office Action alleges it would have been obvious to combine teachings from Lee with teachings in Davidson to maximize the efficiency of coding. As support for this allegation, the Office Action refers to the following statement in Lee:

> ... In order to maximize the efficiency of the run-length coding, the coefficients are ordered in a predetermined manner such that the occurrence of short runs is minimized. ... (col. 13 lns. 47-48)

The predetermined order referred to is the order in which transform coefficients are encountered when traversing along a zig-zag path through an array of coefficients representing spatial frequencies of a two-dimensional image (see col. 13 lns. 50-63). The technical features that are necessary for this technique to work are not present in any embodiments disclosed in Davidson.

As explained above, the encoders in Davidson generate sets of transform coefficients that collectively represent a range of frequencies across the bandwidth of an audio signal. Neither Davidson nor Lee disclose anything that can be used to order or group the audio transform coefficients so that run-length coding as disclosed in Lee can be made more efficient.

A person of ordinary skill in the art would not have even attempted to apply the zig-zag ordering and run-length coding in Lee with the audio coding in Davidson for at least two reasons: (a) there is no obvious way these techniques can be combined, and (b) the combination does not improve efficiency of coding.

If it is still believed the alleged motivation could have existed, Applicants request that the next communication explain how the techniques disclosed in Lee could have been used in Davidson and how the combined techniques can improve efficiency of coding as alleged in the Office Action.

Motivation to Combine Teachings from Holmes with Davidson and Lee

The Office Action alleges it would have been obvious to combine teachings from Holmes with the teachings in Davidson and Lee "to separate the excitation components from the filter components."

As explained above, the filter and excitation components referred to in the Office Action refer to one technique that is used to represent speech signals; namely, a filter that models the vocal tract and an input signal that excites this filter. The cepstral analysis discussed in Holmes is based on a Fourier-transform analysis of the log-magnitude spectrum of a speech signal. The technical features necessary for cepstral analysis are not present in the alleged combination of teachings from Davidson and Lee for several reasons.

First, the cepstral analysis disclosed in Holmes requires a log-magnitude spectrum of a speech signal. The encoders in Davidson all use either evenly-stacked or oddly-stacked forms of Modified Discrete Cosine Transforms (MDCT) disclosed in papers by Princen et al. It is well known from the Princen papers that these MDCT are equivalent to single-sideband cosine modulated filter banks that are not capable of generating coefficients that represent a magnitude spectrum. This is true for two reasons: (a) the MDCT coefficients have only real values and lack the imaginary values needed to compute a true magnitude, and (b) the MDCT coefficients include time-domain aliasing that distort the true spectrum.

Second, the techniques disclosed in Lee reorders the transform coefficients to improve the efficiency of run-length coding. Because of this reordering, cepstral analysis is no longer possible even if the MDCT coefficients could be used to compute a log-magnitude spectrum.

A person of ordinary skill in the art would not have even attempted to apply the cepstral analysis technique in Holmes with the zig-zag ordering and run-length coding in Lee and the audio coding in Davidson for two reasons: (a) there is no obvious way these teachings can be combined, and (b) the combination does not separate excitation and filter components as alleged.

If it is still believed the alleged motivation could have existed, Applicants request that the next communication explain how cepstral analysis can be applied to transform coefficients that have been reordered according to Lee (and, as explained above, Applicants are unable to understand how they could be reordered in this fashion), and how the combined techniques are able to identify and separate a vocal-tract filter from its excitation signal as alleged in the Office Action.

Combined Teachings Do Not Teach All Claim Features

Even if the alleged motivations would have or could have existed, Applicants respectfully submit the combined teachings from Davidson, Lee and Holmes do not reach all claim elements.

The method of claim 1 comprises (the following is an abbreviated list of claim features and letters have been added for reference in the following discussion):

(a) applying a primary transform to overlapping segments of the samples to generate a plurality of sets of spectral coefficients with time-domain aliasing artifacts ....

(b1) obtaining a plurality of spectral coefficients representing the same frequency in the set of frequencies from the plurality of sets of spectral coefficients and

(b2) assembling the plurality of spectral coefficients into one or more blocks of spectral coefficients, wherein the number of spectral coefficients that are assembled in each of the one or more blocks is adapted in response to a block-length control signal.

(c) applying a secondary transform to the one or more blocks of spectral coefficients to generate one or more sets of hybrid-transform coefficients, wherein the length of the secondary transform that is applied to each of the one or more blocks of spectral coefficients is adapted in response to the block-length control signal.

The Office Action correctly indicates Davidson does not disclose features (b1), (b2) and (c) but it does allege features (b1) and (b2) are disclosed in Lee and feature (c) is disclosed in Holmes. Applicants disagree.

Lee discloses a technique that groups or reorders transform coefficients in a single set of coefficients that represent the spatial frequencies of a single block of pixels in an array of non-overlapping blocks of pixels (see col. 4 lns. 9-10). In contrast to this, claim features (b1) and (b2) assembles spectral coefficients from a plurality of sets of transform coefficients that represent the

spectral content of a plurality of overlapping segments of samples. Lee does not disclose assembling, grouping or reordering transform coefficients from plural sets of coefficients. Furthermore, the sets of coefficients in Lee do not represent overlapping segments of samples.

The Office Action correctly indicates neither Davidson nor Lee disclose the adaptive length aspect in feature (c) but it does allege this aspect is disclosed in Holmes. Applicants disagree.

Holmes discloses a cepstral analysis technique that applies a Fourier transform to a log-magnitude spectrum of a speech signal. There is no disclosure or suggestion in Holmes that the length of this transform is adapted. Holmes does disclose a specific form of liftering on p. 163 that truncates the cepstral sequence, effectively excluding the higher coefficients, but this is performed after the transform has been applied. The length of the transform is not changed or adapted.

The Office Action does indicate the use of an adaptive-length transform is disclosed in equation 10.1 on p. 163 and it refers to the symbol N where N=transform length. Applicants agree the symbol N does represent the length of the transform but there is nothing in Holmes that discloses or suggests adaptively changing the value of N. The equation 10.1 is a conventional expression of a fixed-length Discrete Cosine Transform.

If it is still believed Holmes discloses the use of an adaptive-length transform, Applicants respectfully request that the next communication explain what is used to control this length. In other words, please explain what is used to determine the length. Applicants believe an attempt to provide this explanation will show there is no suggestion in Holmes to adapt the transform length.

Independent Claim 6

Claim 6 recites a method that is complementary to the method recited in claim 1. Claim 1 is directed toward encoding a signal. Claim 6 is directed toward decoding an encoded signal.

With regard to claim 6, the Office Action alleges the following:

- Davidson discloses all that is claimed except for applying an adaptive-length inverse secondary transform to one or more sets of hybrid transform coefficients to generate blocks of spectral coefficients representing spectral content for the same frequency;
- Holmes discloses an adaptable-length transform that is applied to cepstrum coefficients;
- Lee discloses a system that groups coefficients of similar frequency;
- it would have been obvious to combine these teachings from Holmes with the teachings in Davison "to reconstruct the excitation components and the filter components"; and
- it would have been obvious to combine these teachings from Lee with the teachings in Davidson "to maximize the efficiency of coding."

Applicants agree Davidson does not disclose the two features mentioned in the Office Action but they respectfully disagree with the remaining four allegations for reasons that are discussed below. Applicants submit that the alleged motivations to combine teachings would not have existed and that these combined teachings do not teach what is claimed.

Summary of Cited Art

Davidson discloses several embodiments of audio decoders in which an adaptable-length inverse transform is applied to sets of transform coefficients to generate overlapping blocks of one-dimensional (time) audio samples. The sets of transform coefficients are discussed above.

Lee discloses aspects of a video compression system that entail processes known as signal analysis (as opposed to signal synthesis). There is no explicit disclosure of signal synthesis.

Holmes discloses aspects of cepstral analysis as explained above. Holmes also discusses one type of cepstral smoothing known as cepstral sequence truncation. The smoothing effects of this truncation are discussed on p. 163 and illustrated in Fig. 10.3(d). The smoothed spectrum illustrated in the figure is obtained by applying a Fourier transform to the truncated cepstrum.

Motivation to Combine Teachings from Holmes and Davidson

The Office Action alleges it would have been obvious to combine teachings from Holmes with teachings in Davidson "to reconstruct the excitation components and the filter components."

Statements in the Office Action omit the fact that Holmes does not disclose applying a transform to just any input but instead discloses applying a transform to only one particular input; a truncated cepstral sequence. This is necessary for the particular analysis disclosed in Holmes. Applicants believe it is without dispute that Davidson does not disclose anything with regard to a cepstrum; therefore, there would not have been a motivation to use teachings from Holmes to reconstruct a smoothed spectrum from a non-existent truncated cepstral sequence.

Motivation to Combine Teachings from Lee with Davidson and Holmes

The Office Action alleges it would have been obvious to combine teachings from Lee with teachings in Davidson and Holmes to maximize the efficiency of coding. Applicants disagree.

The lack of motivation here is analogous to what is discussed above for claim 1. Lee discloses techniques for run-length coding a reordered sequence coefficients representing spatial frequencies of one non-overlapping block of pixels. The inverse of these techniques has no obvious application or implementation in the method of claim 6.

Combined Teachings Do Not Teach All Claim Features

Even if the alleged motivations would have or could have existed, Applicants respectfully submit the combined teachings from Davidson, Lee and Holmes do not teach all claim features.

The method of claim 6 comprises (the following is an abbreviated list of claim features and letters have been added for reference in the following discussion):

(d) applying an inverse secondary transform to the one or more sets of hybrid-transform coefficients to generate one or more blocks of spectral coefficients representing spectral content of the source signal for the same frequency in a set of frequencies, wherein the length of the inverse secondary transform that is applied to the sets of hybrid-transform coefficients is adapted in response to the block-length control signal;

(e) assembling the spectral coefficients into sets of spectral coefficients, wherein each set of spectral coefficients has time-domain aliasing artifacts and represents the spectral content of a segment of the source signal for all frequencies in the set of frequencies;

The Office Action indicates Davidson does not disclose features (d) and (e) but it does allege features (d) is disclosed in Holmes and feature (e) is disclosed in Lee. Applicants disagree.

Holmes discloses applying a fixed-length transform to a truncated cepstral sequence to obtain a smoothed spectrum. The smoothed spectrum represents different frequencies of a speech signal. In contrast to this, feature (d) of claim 6 applies an adaptive-length inverse transform to blocks of hybrid-transform coefficients to obtain blocks of coefficients that represent spectral content for the same frequency. There is nothing in Holmes that discloses or suggests this feature.

For the sake of this discussion only, we assume Lee suggests a run-length decoding technique that is the inverse of the disclosed run-length encoding process that reverses the grouping or reordering of transform coefficients to obtain a single set of coefficients that represent the spatial frequencies of a single block of pixels in an array of non-overlapping blocks of pixels. In contrast to this, claim feature (e) assembles spectral coefficients from a plurality of blocks of coefficients each representing the same frequency into sets of transform coefficients representing the spectral content of a plurality of overlapping segments of samples. Lee does not disclose this feature for reasons that are analogous to those discussed above for claim 1.

Other Claims

The preceding discussion for claims 1 and 6 apply to claims 10, 15, 19 and 22. The remaining claims depend on one of the independent claims and add further limitations thereto. Applicants amend claim the dependencies.

With regard to claims 3 and 12, the Office Action refers to a transient detector in Davidson and alleges this discloses what is claimed. Applicants disagree. The transient detector in Davidson analyzes temporal characteristics of the input signal and controls the length of a transform that corresponds to the primary transform in claim 1. In contrast to this, the features of claim 3 analyze characteristics of the output of the primary transform (after those coefficients have been assembled into sets) and generates a signal that controls the length of the secondary transform. There is nothing in Davidson, Lee or Holmes that suggests using the transient detector in Davidson to analyze the modified output of the primary transform.

CONCLUSION

Applicants amend the claims as shown above and request reconsideration of the claims in view of the preceding discussion.

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Certificate of Transmission

I certify that this Response to Office Action and any following materials are being transmitted by facsimile on January 30, 2008 to the U.S. Patent and Trademark Office at telephone number (571) 273-8300.

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